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# NASA Procedural Requirements

**NPR 2570.1**

Effective Date: April 24, 2003

Expiration Date: April 24,  
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## Subject: NASA Radio Frequency (RF) Spectrum Management Manual

**Responsible Office: Space Operations Mission Directorate**

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## Appendix G: Determination Emissions and Bandwidths

### G.1 Full Designation of Emission

The full designation of an emission consists of alphanumeric symbols for the classification of the emission preceded by a number indicating the necessary bandwidth in kilohertz as delineated in the NTIA Manual paragraph 9.8.2.16. The classification symbols are described in paragraph H.2 and the procedure for calculating the necessary bandwidth is given in paragraph H.3.

### G.2 Classification of Emissions

Emissions are classified by alphanumeric symbols that represent the type of modulation of the carrier, type of transmission, and supplementary characteristics of the transmitting system. The basic emission designator consists of three symbols, and if desired, two optional additional symbols, as derived from Tables H-1 to H-5.

#### Table G-1. First Symbol-designates the type of modulation of the main carrier

Symbol..... Type of Emission

#### Unmodulated

N..... Emission of an unmodulated carrier.

#### Amplitude Modulated

*Emission in which the main carrier is amplitude-modulated (including cases where sub-carriers are angle-modulated):*

- A..... Double sideband.
- B..... Independent sidebands.
- C..... Vestigial sideband.
- H..... Single sideband, full carrier.
- J..... Single sideband, suppressed carrier.
- R..... Single sideband, reduced or variable level carrier.

#### Angle Modulated

*Emission in which the main carrier is angle-modulated:*

F..... Frequency modulation.

G..... Phase modulation.

## **Amplitude-Modulated and Angle modulated**

D ..... Emission in which the main carrier is amplitude

modulated and angle-modulated either simultaneously or in a preestablished sequence.

## **Pulse**

*Emission of pulses:*

(Emissions, where the main carrier is directly modulated by a signal which has been coded into quantized form (e.g., pulse code modulation), shall be designated as either an emission in which the main carrier is amplitude-modulated, or an emission in which the main carrier is angle-modulated).

P..... Sequence of unmodulated pulses.

Symbol..... Type of Emission

*A sequence of pulses:*

K..... Modulated in amplitude.

L..... Modulated in width or duration.

M..... Modulated in position or phase.

Q..... Carrier is angle-modulated during the period of the pulse.

V..... A combination of the foregoing or produced by other means.

## **Combination**

W..... Cases not covered above, in which an emission consists

of the main carrier modulated, either simultaneously or in a combination of two or more of the following modes: amplitude, angle, pulse.

X<sup>1</sup>..... Cases not otherwise covered.

<sup>1</sup>A full explanation for the selection of the letter X shall be provided in the Supplementary Details (SUP) unless the application is for a nondirectional beacon in the bands 190-435 and 510-535 kHz.

## **Table G-2. Second Symbol-designates the nature of signal(s) modulating the main carrier**

Symbol.....Type of Emission

0..... No modulating signal.

1..... A single channel\* containing quantized or digital signals without the use of a modulating subcarrier. (This excludes time division multi-plex.)

2..... A single channel\* containing a quantized or a digital signal with the use of modulating subcarrier.

3..... A single channel\* containing an analogue signal.

7..... Two or more channels\* containing quantized or digital signals.

8..... Two or more channels\* containing analogue signals.

9..... A composite system with one or more channels\*  
containing quantized or digital signals, togeth-er with one or more channels containing analogue signals.  
X<sup>1</sup>..... Cases not otherwise covered.

\*In this context, the word "Channel(s)" refers to the radio frequency (RF) channel.

<sup>1</sup>A full explanation for the selection of the letter X shall be provided in the Supplementary Details (SUP) unless the application is for a nondirectional beacon in the bands 190-435 and 510-535 kHz

**Table G-3. Third Symbol--designates the type of information to be transmitted (In this context the word "information" does not include information of a constant, unvarying nature such as provided by standard frequency emissions, continuous wave and pulse radars, etc.)**

Symbol..... Type of Emission

N..... No information transmitted.

A..... Telegraphy--for aural reception.

B..... Telegraphy--for automatic reception.

C..... Facsimile.

D..... Data transmission, telemetry, telecommand;

(the symbol D indicates that data, telemetry, or telecommand information is being transmitted individually or, that any combination of the three are being transmitted simultaneously. If any combination *is* being transmitted simultaneously, one of the multi-channel symbols, 7, 8, or 9, must be used for the second symbol).

E..... Telephony (including sound broadcasting).

F..... Television (video).

W..... Combination of the above. (Use only for  
multichannel systems having the capability of trans-mitting all informa-tion simultaneous-ly).

X<sup>1</sup>..... Cases not otherwise covered.

<sup>1</sup>A full explanation for the selection of the letter X shall be provided in the Supplemen-tary Details (SUP) unless the applica-tion is for a nondirectional beacon in the bands 190-435 and 510-535 kHz.

**Table G-4. Fourth Symbol--designates the details of signal(s)**

Symbol..... Type of Emission

A..... Two condition code with elements of differing  
numbers and/or durations.

B..... -Two condition code with elements of the same  
number and duration without error correction.

C..... Two condition code with elements of the same  
number and duration with error cor-rection.

D..... Four condition code in which each condition  
repre-sents a signal element (of one or more bits).

E..... Multicondition code in which each condition  
repre-sents a signal element (of one or more bits).

F..... Multicondition code in which each condition  
or combi-nation of conditions represents a char-acter.

G..... Sound of broadcasting quality (mono-phonic).  
 H..... Sound of broadcasting quality (stereo-phonic or quadra-phonic).  
 J..... Sound of commercial quality (excluding ..... categories defined for symbols K and L below).  
 K..... Sound of commercial quality with the use of frequen-cy inversion or band splitting.  
 L..... Sound of commercial quality with separate frequ-ency- modulated signals to control the level of demodu-lated signal.  
 M..... Monochr-ome.  
 N..... Color.  
 W..... Combination of the above.  
 X..... Cases not otherwise covered.

### **Table G-5. Fifth Symbol--designates the nature of multiplexing**

Symbol..... Type of Emission  
 N..... None.  
 C..... Code division multiplex (This includes band-  
 -width expansion tech-niques).  
 F..... Frequency division multiplex.  
 T..... Time division multiplex.  
 W..... Combination of frequency division multiplex and  
 time division multiplex.  
 X..... Other types of multiplexing.

#### *Examples:*

#### Designator Type of Emission

Non Continuous wave.

1K24F1B 1.24 kHz necessary bandwidth for frequency modulated single chan-nel telegraphy.

16KF3EJN 16 kHz necessary bandwidth for com-mer-cial telephony.

### **G.3 Determination of Necessary Bandwidths**

1. The necessary bandwidth is the minimum value of bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed. Emissions needed for satisfactory functioning of the receiving equipment (such as the carrier in reduced-carrier systems, or a vestigial sideband but not the effect of Doppler) are included in the necessary bandwidths.
2. When the full designation of an emission is required, the symbol for that emission (as given in paragraph H.2) is preceded by the number of Hertz, kHz or MHz (see examples) required for the necessary bandwidths. Bandwidths are generally expressed to a maximum of three significant digits with the third digit usually being a multiple of five.
3. To calculate the necessary bandwidths, refer to Annex J of the NTIA Manual. (This table also gives examples of the calculation of necessary bandwidths and full designation of corresponding emissions.) The necessary bandwidths can also be computed in accordance with ITU-R Recommendation SM.328. In cases in which computation is not practical, the necessary bandwidth can be obtained by measurement.
4. The value of necessary bandwidth determined by calculation or measurement should be used in designating the full emission. The necessary bandwidths so determined are not the only characteristic of an emission to be

considered in evaluating the interference caused by that emission.

5. Further, more detailed, information on the method of calculation of necessary bandwidth is available in Annex J of the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management (current edition).

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